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REC'D 09 FEB 1998

PCT

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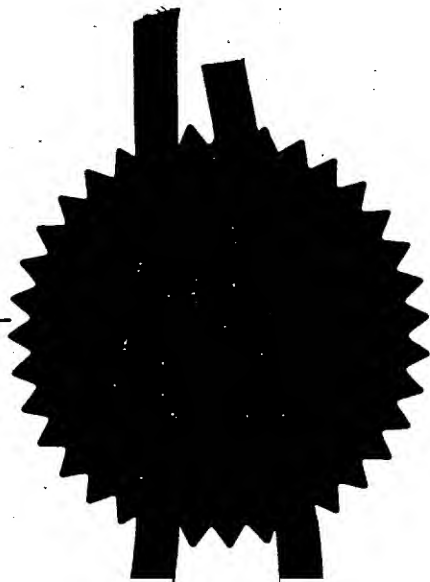
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Dated 22 December 1997



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The
Patent
Office

Request for grant of a Patent

Form 1/77

Patents Act 1977

1 Title of invention

1 Please give the title of the invention

CONTROL OF DUST AND SMALL PARTICLES IN CARPETS

2 Applicant's details

☐ First or only applicant

2a If you are applying as a corporate body please give:

Corporate name UNIVERSITY OF SOUTHAMPTON

Country (and State of incorporation, if appropriate)

UK

2b If you are applying as an individual or one of a partnership please give in full:

Surname

N/A

Forenames

2c In all cases, please give the following details:

Address

BOULT WADE TENNANT
27 FURNIVAL STREET
LONDON
EC4A 1PQ

UK postcode (if applicable)

SO17 1BJ

Country

UK

ADP number (if known)

CO798470002 12

51/77
4/12/97
SMN

2a, 2b and 2f: If there are further applicants please provide details on a separate sheet of paper.

☐ **Second applicant (if any)**

2d If you are applying as a corporate body please give:

Corporate name

N/A

Country (and State
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appropriate)

2e If you are applying as an individual or one of a partnership please give in full:

Surname

Forenames

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① An address for service in the United Kingdom must be supplied

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② **Address for service details**

3a Have you appointed an agent to deal with your application?

Yes ☐ No ☒ → go to 3b

↓
please give details below

Agent's name

Agent's address

Postcode

Agent's ADP
number

3b: If you have appointed an agent, all correspondence concerning your application will be sent to the agent's United Kingdom address.

3b If you have not appointed an agent please give a name and address in the United Kingdom to which all correspondence will be sent:

Name MR PETER HUGHES

Address OFFICE OF INNOVATION & RESEARCH SUPPORT
UNIVERSITY OF SOUTHAMPTON
HIGHFIELD
SOUTHAMPTON

Postcode SO17 1BT

ADP number
(if known)

Daytime telephone number (if available) 01703/594680

07028327001 12

④ Reference number

4 Agent's or
applicant's reference
number (if applicable)

0657/01

⑤ Claiming an earlier application date

5 Are you claiming that this application be treated as having been filed on the date of filing of an earlier application?

Yes ☐ No ☒ ⇒ go to 6

↓
please give details below

☐ number of earlier
application or patent
number

☐ filing date

day month year

☐ and the Section of the Patents Act 1977 under which you are claiming:

15(4) (Divisional) ☐ 8(3) ☐ 12(6) ☐ 37(4) ☐

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⑥ If you are declaring priority from a
PCT Application please enter 'PCT' as
the country and enter the country
code (for example, GB) as part of the
application number.

Please give the date in full number
format, for example, 31/05/90 for
31 May 1990.

⑥ Declaration of priority

6 If you are declaring priority from previous application(s), please give:

Country of filing	Priority application number (if known)	Filing date (day, month, year)
	N/A	

The answer must be 'No' if:

- any applicant is not an inventor
- there is an inventor who is not an applicant, or
- any applicant is a corporate body.

Please supply duplicates of claim(s), abstract, description and drawing(s).

Please mark correct box(es)

- ① You or your appointed agent (see Rule 90 of the Patents Rules 1990) must sign this request.

Please sign here ➡

A completed fee sheet should preferably accompany the fee.

⑥ Inventorship

7 Are you (the applicant or applicants) the sole inventor or the joint inventors?

Please mark correct box

Yes ☐

No ☒

A Statement of Inventorship on Patents Form 7/77 will need to be filed (see Rule 15).

⑦ Checklist

8a Please fill in the number of sheets for each of the following types of document contained in this application.

Continuation sheets for this Patents Form 1/77

0

Claim(s)

0

Description

2

Abstract

0

Drawing(s)

2

8b Which of the following documents also accompanies the application?

Priority documents (please state how many)

0

Translation(s) of Priority documents (please state how many)

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Patents Form 7/77 – Statement of Inventorship and Right to Grant (please state how many)

0

Patents Form 9/77 – Preliminary Examination/Search

0

Patents Form 10/77 – Request for Substantive Examination

0

⑧ Request

(We request the grant of a patent on the basis of this application.)

Signed Peter Hughes Date 4-12-96
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Control of Dust and Small Particles in Carpets

The present invention relates to methods and apparatus for controlling dust and small particles, which may include allergens, in carpets and other materials and in particular for removing such dust and particles.

Vacuum cleaners are well known in removing dust and small particles from carpets. Although most commercial vacuum cleaners will remove dust and particles from carpets quite efficiently, there will always be some particles left in the carpet. It is normally the very fine particles which will be most difficult to remove. Particles below $10\mu\text{m}$ in diameter, which are lodged deep in the carpet pile near the backing, will always be difficult to remove efficiently. It is these particles that are considered to be most hazardous in terms of health implications.

Particles of up to $10\mu\text{m}$ in diameter (commonly called PM_{10} 's) can remain airborne for long periods of time and are small enough to be inhaled into the human respiratory system. House dust mite allergen, *Dermatophagoides pteronyssinus* (Der p I), is known to reside on mite faecal particles and is now recognised as the most common allergen associated with asthma.

The simple action of using a vacuum cleaner will disturb particles and cause them to become airborne and produce a high level of airborne allergens. Even PM_{10} 's which are removed by a vacuum cleaner may well not be captured in the vacuum cleaner filter and may subsequently be released into the atmosphere.

The object of the present invention is to provide an improved method and apparatus for restricting the number of airborne particles during cleaning ('Damp-Down'), enhance removal of small particles from the carpet and other materials ('Mop-Up'), and increase the capacity of the vacuum cleaner to hold onto small particles once captured ('Stay-Pur').

According to the invention electrostatically charged carrier particles are used to capture dust and small particles to prevent them from becoming airborne and aid in the removal from the carpet. The charged carrier particles are delivered to the carpet and agglomerate with small particles to form larger particles. These larger particles can then be removed by a normal vacuum cleaning process.

The carrier particles may be charged in one of, or in a combination of, methods. The carrier particles may be pre-charged before being inserted into the dispenser. The carrier particles may be charged as they are dispensed onto the carpet. A multi-component carrier system may be used where carrier particles are made from different materials and tribo-charge against each other as they are dispensed onto the carpet, i.e. Carrier/Carrier Charging. These methods are shown in Figure 1. As the carrier particles are dispensed, the carpet should be agitated to ensure capture of dust. This agitation may be conducted by the dispenser or by the sweeping action on cleaning or by other means. Figure 1 also shows the three objectives of the carrier powder: "Damp-Down", "Mop-Up" and "Stay-Pur".

In order that the invention may be more readily understood an embodiment of one of the three methods detailed in Figure 1 will now be described with reference to the accompanying drawings in which

Figure 1 shows a flow diagram of the three methods.

Figure 2 is a diagram of a possible embodiment of one of the methods, Carrier/Dispenser Charging.

With reference to Figure 2 a dispenser 1 consisting of a container 2 and dispensing tube 3 contains carrier particles and other components 4. The carrier particles are electrically insulating (for example Nylon) of the order of $100\mu\text{m}$ in diameter. The carrier particles become charged as they travel through the dispensing tube 3 (for example Teflon) and keep their charge as they reach the carpet 5.

In use, the dispenser 1 is positioned above a carpet 5 and the container 2 is squeezed to deliver charged carrier particles to the surface of the carpet. As the container 2 is squeezed air from the air pocket 6 is forced down the dispensing tube 3 through the gas phase inlet 7. At the same time carrier particles 4 are also forced into the dispensing tube 3 through the solid phase inlet 8. The air and carrier particles in the dispensing tube mix and are forced through the charging region 9 and delivered through the outlet 10. The carrier particles acquire charge as they collide with the surface of the dispensing tube 3 in the charging region 9.

The charged carrier particles may be agitated on the surface of the carpet so that they fall down deep into the pile of the carpet close to the backing. The charged carrier particles come into contact with the smaller dust and allergen containing particles and attract these smaller particles so as to form agglomerates.

The agglomerates can be removed from the carpet by a vacuum cleaning process or by using a brush. The larger agglomerates will be easier to remove from the carpet by the action of the mechanical forces imparted by a vacuum cleaning process action of mechanical agitation and vacuum suction. The agglomerates are less likely to become airborne and certainly will not be able to remain in suspension for long periods of time. In addition, once the small particles (PM_{10} 's) are in the vacuum cleaner within the agglomerates, their escape through the filtration system of the cleaner will likewise be reduced.

The charge on the carrier particle can be positive or negative or the carrier particles can be a mixture of both as in method two of Figure 1.

From the above description it will be clear that by agglomerating the small dust and allergen containing particles with the charged carrier particles the dust and allergens are prevented from becoming airborne ("Damp-Down"). The agglomerated particles will be more easily removed from the carpet by cleaning ("Mop-Up"). Further, the agglomerates will not escape through the filtering system of the vacuum cleaner ("Stay-Pur").

As an alternative to using the dispenser 1 the charged particles may be dispensed by a cleaning apparatus, such as a vacuum cleaner. They are deposited on a carpet surface, agitated so that they agglomerate with the small particles and subsequently collected by the cleaning apparatus.

1/2.

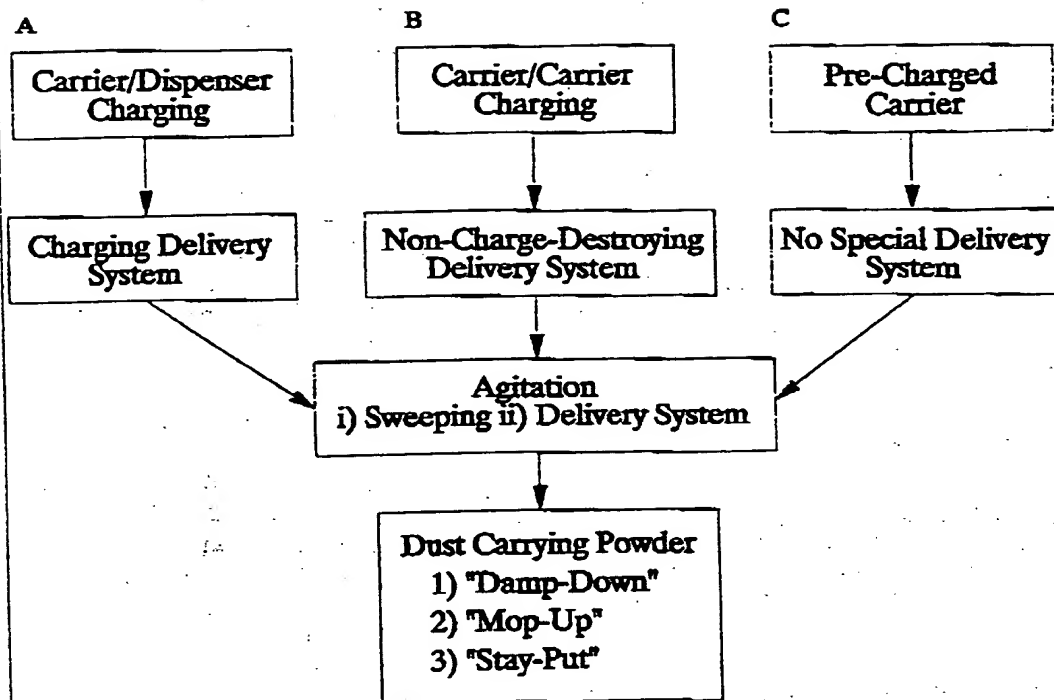


Figure 1

2/2.

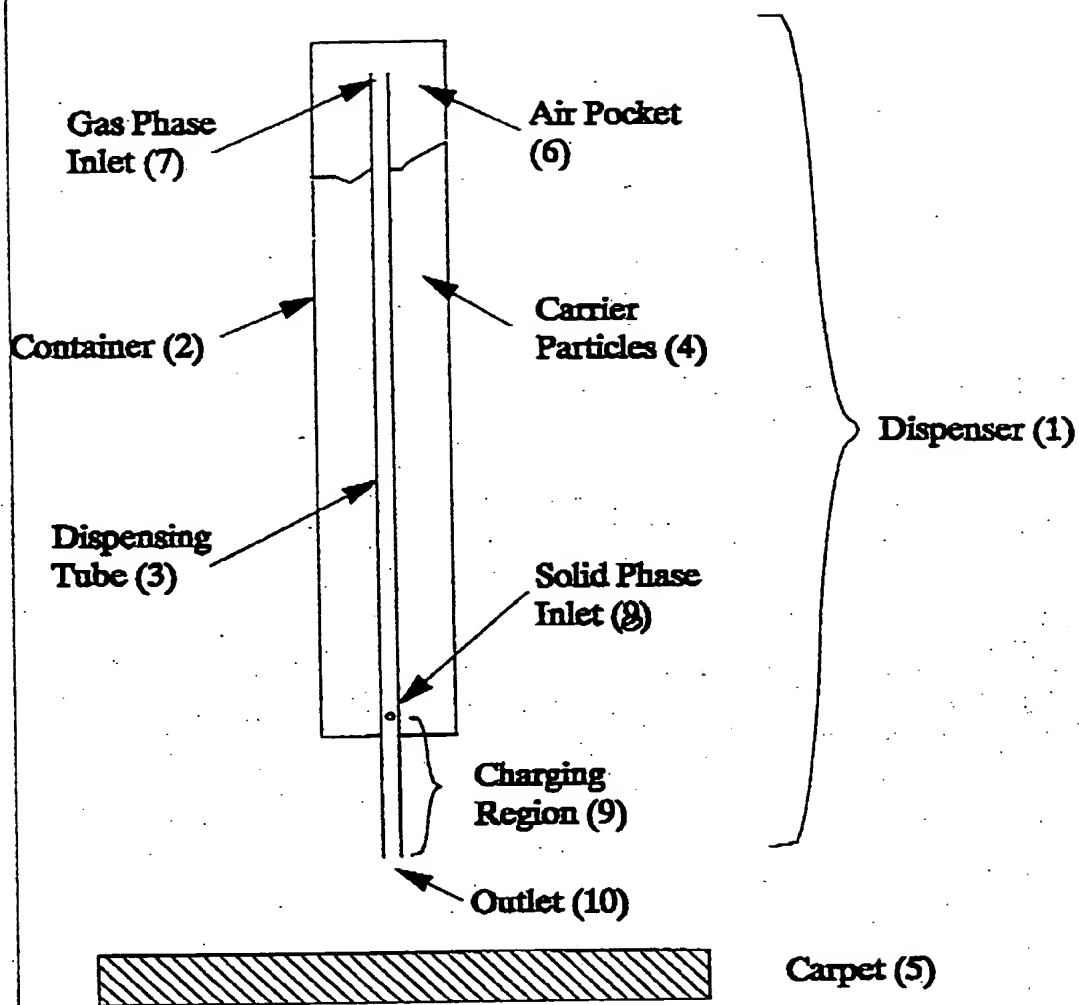


Figure 2